

June 25, 1964

Dr. R. B. Leighton  
Norman Bridge Laboratory of Physics  
California Institute of Technology  
Pasadena, California

Dear Dr. Leighton:

The Space Science Board of the National Academy of Sciences, at the request of the National Aeronautics and Space Administration, has undertaken to review the scientific aims and methodology of the search for extraterrestrial life. In order to economize on the time of scientific specialists, we are departing from the too customary multiplication of large scale meetings and will rely to the largest possible extent on communication by mail and on reference to the literature. A Working Group has accepted the burden of drafting a summary report. We expect to use contributed material just as received from or amended by the contributors as supporting documentation.

Until recently, NASA's major efforts in exobiology were focussed on missions involving vehicles of the Atlas and similar types. Prospects with these rockets are limited, at best, to the landing of a few pounds of instruments on Mars, with a minimum of supporting power and telemetry. However, the rapid progress of the Saturn systems now makes it possible to consider a totally different kind of program, in which payloads of up to 20 tons might be landed on Mars. The complexities of such missions and the importance of early planning are self-evident, even though 1969 or 1971 are the earliest conceivable dates on which these attempts might be made.

Against this background, we ask you specifically to consider the assignment described below.

As a basis for further scientific and engineering study, we are attempting to enumerate the functions which should be embodied in an analytical system for biological study of Mars - that is, the characteristics of an ensemble of scientific instruments to be landed on the planet. At the same time, we wish to assure ourselves that we are giving appropriate priority to the investigations to be undertaken and to the various means of pursuing them. The selection

of these is tentative and subject to much revision, but a beginning is needed.

The problems under consideration are:

1. The diagnosis of the presence of life on Mars, under various assumptions of the extent of its evolution and of its divergence from the terrestrial system.
2. If life is present, the characterization of its composition, metabolism, ecology, and history.
3. The characterization of the Martian environment, particularly but not exclusively in connection with evidence for existing life and for the possibility of the colonization of Mars by terrestrial organisms.

Special emphasis has been placed on the examination of soil for microbial activity, and facilities for acquiring samples of it have already been considered. If other kinds of samples are important, what are they and how might they be acquired for analysis? The present discussion centers on experiments in situ, with telemetry back to earth. Return of samples to the earth is outside present consideration.

Of a series of instrumental approaches, partly summarized on the attached list, we would especially ask your detailed comment on:

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Principally we would want your best judgement on the relative interest that this method should attract in dealing with the basic problems as stated above. Engineering details should be of minimum concern to you, though any remarks you may have on the possibility and directions of miniaturizing the instrumentation, if necessary, would be welcome. More important is your assessment of the ways in which the instrument (or technique) can contribute to solution of these problems; the interpretability or ambiguity of its indications and quantitative statements on present and expected limits of sensitivity; constraints on type and size of samples, and requirements for sample preparation and treatment.

Experience has shown that some seemingly absurd ideas need careful consideration, and precisely for this reason, several instrumental approaches are listed although a superficial consideration would tend to exclude them.

A preliminary draft of a note on "Signs of Life" is attached to help provoke the passionate response to which we look forward. A capsule summary of our current knowledge of Mars, which is germane

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to the topic, is also enclosed; a more detailed report on "The Atmospheres of Mars and Venus" will be forwarded to you under separate cover.

Dr. John McCarthy, of Stanford University, has agreed to receive and prepare your comments for distribution to the Working Group; please send them to: Space Science Board, National Academy of Sciences, 800 Welch Road - Suite 214, Palo Alto, California, telephone: 324-0091. Additional information relating to this effort will be provided as may be necessary.

I hope this letter will elicit your interest, and hopefully, some preliminary comments before the preparation of the first draft of the report on July 15.

Very truly yours,

Joshua Lederberg

JL/jd

enclosures

cc: Dr. John McCarthy  
Dr. D. G. Rea